

The Gruneisen and Phase Identification Parameters as Useful Tools in Evaluating Equations of State

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Two new parameters have recently become key tools for evaluating equations of state. These are the Gruneisen parameter and the phase identification parameter (PIP). The visualization of these new parameters, along with the isochoric and isobaric heat capacities and speed of sound, can help identify key problems during the development of an equation. In particular, the new parameters are more sensitive than those that have been used for decades, and can show areas needing improvement that otherwise would go unnoticed. With these, the extrapolation behavior of an equation can be fashioned so that the equation predicts results as well as possible in the absence of data. This is particularly important for mixtures since low temperature calculations will often use states below the triple point of one of the fluids. Thermodynamic definitions of the Gruneisen parameter and PIP are reviewed in context with definitions of related derivatives of the Helmholtz potential. Plots of these parameters for fluids currently being developed, including helium, ammonia, and propylene, will be given, along with details of older equations, to demonstrate the advancement of the state of the art.